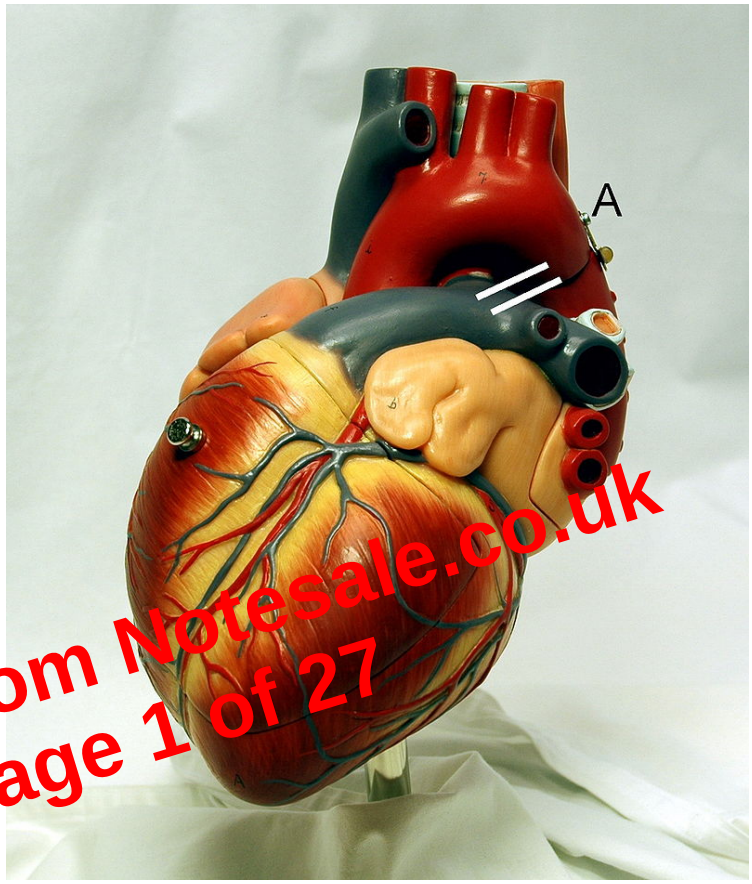
Human Physiology/The cardiovascular system

← Blood physiology — **Human Physiology** — The Immune System →

Homeostasis — Cells — Integumentary — Nervous — Senses — Muscular — Blood — Cardiovascular — Immune — Urinary — Respiratory — Gastrointestinal — Nutrition — Endocrine — Reproduction (male) — Reproduction (female) — Pregnancy — Genetics — Development — Answers

Introduction



Model of a human heart

The heart is the life-giving, ever-beating muscle in your chest. From inside the womb until death, the thump goes on. The heart for the average human will contract about 3 billion times; never resting, never stopping to take a break except for a fraction of a second between beats. At 80 years of age, a person's heart will continue to beat an average of 100,000 times a day. Many believe that the heart is the first organ to become functional. Within weeks of conception the heart starts its mission of supplying the body with nutrients even though the embryo is no bigger than a capital letter on this page. The primary function of the heart is to pump blood through the arteries, capillaries, and veins. There are an estimated 60,000 miles of vessels throughout an adult body. Blood transports oxygen, nutrients, disease causing viruses, bacteria, hormones and has other important functions as well. The heart is the pump that keeps blood circulating properly. Americans today have many options to take care of their heart and circulatory system. Expanding medical technology has made it much easier to do so. This chapter is dedicated to the heart and its many parts.

The Heart

The heart is a hollow, muscular organ about the size of a fist. It is responsible for pumping blood through the blood vessels by repeated, rhythmic contractions. The heart is composed of cardiac muscle, an involuntary muscle tissue that is found only within this organ. The term "cardiac" (as in cardiology) means "related to the heart" and comes from the Greek word kardia, for "heart." It has a four-chambered, double pump and is located in the thoracic cavity between the lungs. The cardiac muscle is self-exciting, meaning it has its own conduction system. This is in contrast with skeletal muscle, which requires either conscious or reflex nervous stimuli. The heart's rhythmic contractions occur spontaneously, although the frequency or heart rate can be changed by nervous or hormonal influence such as exercise or the perception of danger.

Aneurysm

An aneurysm (or aneurism) is a localized dilation or ballooning of a blood vessel by more than 50% of the diameter of the vessel and can lead to instant death at anytime. Aneurysms most commonly occur in arteries at the base of the brain (the circle of Willis) and in the aorta (the main artery coming out of the heart) - this is an aortic aneurysm. This bulge in a blood vessel, much like a bulge on an over-inflated inner tube, can lead to death at anytime. The larger an aneurysm becomes, the more likely it is to burst. Aneurysms are also described according to their shape: Saccular or fusiform. A saccular aneurysm resembles a small sack; a fusiform aneurysm is shaped like a spindle.

Dissolving Blood Clots

To dissolve blood clots you would use a drug that converts plasminogen (molecule found in blood), to plasmin, (enzyme that dissolves blood clots).

Clearing Clogged Arteries

One way to unblock a coronary artery (or other blood vessel) is percutaneous transluminal coronary angioplasty (PTCA), which was first performed in 1977. A wire is passed from the femoral artery in the leg or the radial artery in the arm up to the diseased coronary artery, to beyond the area of the coronary artery that is being worked upon. Over this wire, a balloon catheter is passed into the segment that is to be opened up. The end of the catheter contains a small folded balloon. When the balloon is hydraulically inflated, it compresses the atheromatous plaque and stretches the artery wall to expand. At the same time, if an expandable wire mesh tube (stent) was on the balloon, then the stent will be implanted (left behind) to support the new stretched open position of the artery from the inside.

Dilated and Inflamed Veins

Varicose Veins

Varicose veins are veins on the leg which are large, twisted, and ropelike, and can cause pain, swelling, or itching. They are an extreme form of telangiectasia, or spider veins. Varicose veins result due to insufficiency of the valves in the communicating veins. These are veins which link the superficial and deep veins of the lower limb. Normally, blood flows from the superficial to the deep veins, facilitating return of blood to the heart. However, when the valve becomes defective, blood is forced into the superficial veins by the action of the muscle pump (which normally aids return of blood to the heart by compressing the deep veins). People who have varicose veins are more at risk of getting a Deep Vein Thrombosis (DVT) and pulmonary embolisms.

B) Purkinje fibers

C) AV Bundle

D) SA node

E) None of these, a pacemaker is surgically inserted

5. When reading an EKG, this letter shows the depolarization from the AV node down to the AV bundle

A) S

B) P

C) U

D) T

E) Q

6. The T wave in an EKG shows

A) Resting potential

B) Atrial depolarization

C) SA node excitation

D) Ventricle repolarization

E) Purkinje Excitation

7. Blood pressure is the measure of

A) Pressure exerted by the blood on the walls of the blood vessels

B) Pressure exerted by the blood on the arteries

C) Pressure exerted by the blood on the veins

D) Pressure exerted by the blood on the aorta

E) Pressure exerted by the blood on the capillaries

8. Systolic Pressure is

A) An average of 120 mm Hg

B) Lowers steadily during ventricle systole

C) The highest when blood is being pumped out of the left ventricle into the aorta

D) An average of 80 mm Hg

E) Both A and C

F) Both B and D

9. The heart has how many chambers?

A) One

B) Two

C) Three

D) Four

E) Five

Inferior Vena Cava (or IVC): a large vein that carries de-oxygenated blood from the lower half of the body into the heart

Intraventricular Septum: the stout wall separating the lower chambers (the ventricles) of the heart from one another

Left Atrium:receives oxygenated blood from the left and right pulmonary veins

Lub-Dub: first heart tone, or S1; caused by the closure of the atrioventricular valves, mitral and tricuspid, at the beginning of ventricular contraction, or systole

Lumen: hollow internal cavity in which the blood flows

Lymph: originates as blood plasma that leaks from the capillaries of the circulatory system, becoming interstitial fluid, filling the space between individual cells of tissue

Mitral valve: also known as the bicuspid valve; prevents blood flowing from the left ventricle into the left atrium

Myocardium: the muscular tissue of the heart.

Norepinephrine: Produced in the adrenal medulla of the adrenal glands, major function is a strong vasoconstrictor that will in turn increase respiratory rate.

Pacemaker Cells: cells that create these rhythmical impulses of the heart

Plaque: an abnormal inflammatory accumulation of macrophage white blood cells within the walls of arteries

Pulmonary Valve: lies between the right ventricle and the pulmonary artery; prevents back-flow of blood into the ventricle

Pulse: the number of heartbeats per minute

Purkinje Fibers (or Purkinje tissue): located in the inner ventricular walls of the heart, just beneath the endocardium; specialized myocardial fibers that conduct an electrical stimulus or impulse that enables the heart to contract in a coordinated fashion

Renin-Angiotension system:

Right Atrium: receives de-oxygenated blood from the superior vena cava and inferior vena cava

Serous Pericardium: functions in lubricating the heart to prevent friction from occurring during heart activity

Semilunar Valves: positioned on the pulmonary artery and the aorta

Sinoatrial Node: (abbreviated SA node, or SAN, also called the sinus node): the impulse generating (pacemaker) tissue located in the right atrium of the heart

Sinusoidal Capillaries: special forms of fenestrated capillaries that have larger opening allowing RBCs and serum proteins to enter

Systole: contraction of the heart

Systolic Pressure:' the highest point in blood pressure when the blood is being pumped out of the left ventricle into the aorta during ventricular systole

Superior Vena Cava (SVC): a large but short vein that carries de-oxygenated blood from the upper half of the body to the heart's right atrium

Thrombus: a blood clot in an intact blood vessel

Tricuspid Valve: on the right side of the heart, between the right atrium and the right ventricle; allows blood to flow from the right atrium into the right ventricle when the heart is relaxed during diastole

Vasoconstriction: the constriction of blood vessels

Vasodilation: the dilation of blood vessels

Veins:carry de-oxygenated blood from the capillary blood vessels to the right part of the heart

Ventricle: a heart chamber which collects blood from an atrium

Venule: a small blood vessel that allows deoxygenated blood to return from the capillary beds to the larger blood vessels called